

## **THE CLAIMS**

What is claimed is:

1. A method for preparing a bonding surface of a semiconductor layer of a wafer comprising:
  - treating the bonding surface to oxidize contaminants;
  - cleaning the bonding surface to remove essentially all remaining
  - 5 contaminants; and
  - oxidizing the bonding surface with ozone to improve the hydrophilic properties of the bonding surface.
2. The method of claim 1 wherein the cleaning of the bonding surface comprises
- 10 treating the bonding surface with a first solution capable of removing isolated and encrusted particles, and then treating the bonding surface with a second solution capable of removing metallic contamination.
3. The method of claim 2 wherein the first solution is a SC1 solution that
- 15 includes ammonium hydroxide ( $\text{NH}_4\text{OH}$ ), hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) and deionized water.
4. The method of claim 2 wherein the second solution is a SC2 solution that includes hydrochloric acid ( $\text{HCl}$ ), hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) and deionized water.
- 20 5. The method of claim 1 wherein the cleaning step includes applying ultrasonic energy to assist in removing particulate contamination from the bonding surface.
6. The method of claim 1 wherein the oxidizing comprises at least one of
- 25 immersing the bonding surface in an ozone bath, or spraying ozone droplets onto the bonding surface, or exposing the bonding surface to an ozone gas.

7. The method of claim 1 which further comprises preparing a bonding surface of a second wafer by treating the bonding surface to oxidize contaminants, cleaning the bonding surface to remove essentially all remaining contaminants, and oxidizing the bonding surface with ozone to improve the hydrophilic properties of the bonding surface, followed by contacting the bonding surface of the first wafer to the bonding surface of the second wafer to effect bonding therebetween and form a structure.
8. The method of claim 7 wherein the bonding is at least partly achieved by hydrophilic adhesion of the bonding surfaces of the first and second wafers.
9. The method of claim 7 further comprises applying a heat treatment to the structure to strengthen the bond between the first and second wafers.
10. The method of claim 7 wherein the bonding surface of the second wafer exists on an oxide layer.
11. The method of claim 10 wherein the semiconductor structure is a semiconductor on insulator (SOI) structure.
12. The method of claim 10 wherein the oxide layer is an insulating layer.
13. The method of claim 7 wherein the bonding surfaces of each of the first and second wafers exist on an oxide layer.
14. The method of claim 13, wherein each oxide layer is an insulating layer.
15. The method of claim 7, wherein at least one of the first or second wafers includes a zone of weakness to facilitate detachment of the structure.
16. The method or claim 7, wherein the semiconductor wafer comprises silicon, germanium, SiGe, AlGaAs, GaAs, InGaAs, AlGaAsP, InGaAsP, InP, or another Group III-Group V semiconductor or Group II-Group VI semiconductor.

17. The method of claim 1, wherein the first wafer includes a zone of weakness to facilitate detachment of a layer that includes the bonding surface.
18. In a method for preparing a bonding surface of a semiconductor layer of a wafer for bonding to a second wafer wherein the bonding surface is cleaned to remove contaminants, the improvement which comprises oxidizing the bonding surface with ozone to improve the hydrophilic properties of the bonding surface.
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